

THE UNITED STATES OF AMERICA,



To stimulate her citizens in the development of her resources, industries and commerce, established the Patent Office July 4, 1836, for the purpose of securing to inventors the proprietary rights to their ideas for a brief term of years.

Under this beneficent provision many and great improvements have been made in the Arts and Sciences, resulting in the promotion of the general welfare of the country.

Amongst these may be mentioned a device known as a *Reaction Breakwater*, for the opening up of commercial channels across the sand-bars so frequently found obstructing harbor entrances, and for which letters patent have been issued to Lewis M. Haupt, of Philadelphia. The novelty, utility and great economy of this invention have been recognized and attested by scientific societies, distinguished engineers, jurors and experts, and are also demonstrated by actual practical results, as briefly stated in the accompanying pages.

The attention of all persons interested in the economics of transportation is respectfully invited to the great possibilities of this system as outlined herein. In a single present, yet they reduced the estimated cost of securing a channel seven millions of dollars. It has been spent in



THE FIRST HONOR

The American Philosophical Society, after thorough investigation extending over nearly one year, awarded its rare and highly-prized

MAGELLANIC PREMIUM,

a gold medal, to the inventor for "his discovery in Physical Hydrography, and for his invention of a System of Harbor Improvements," Dec. 17, '87.

PRESENTATION ADDRESS

Hall of the American Philosophical Society, 104 S. Fifth St., Phila., May 4, 1888:

"Prof. Haupt, it is a great gratification to me, both personally and officially, to present to you the Magellanic Premium, which has been awarded by the American Philosophical Society for your essay on 'The Physical Phenomena of Harbor Entrances, their Causes and Remedies.' This essay treats of matters of great national importance, and your discussion of them will greatly tend to the improvement of the methods now in use for effecting the permanent removal of obstacles in our harbors and rivers, which are so dangerous to navigation, and are so full of the lands and buildings along their shore lines. A glance at the map of the United States shows the great number of our navigable rivers and vast extent of coast lines, and the importance of our harbor entrances, and it is therefore important that money ap

propriated for their improvement and enlargement shall be wisely and scientifically expended. I think these suggestions will be found very valuable in securing stability to all artificial structures that may be erected in our great waters for their protection and convenient use, and you are therefore entitled to be honored as a public benefactor. The Magellanic Premium was established in the year 1786, and the records of the society show that only six awards of the medal and one honorary pecuniary premium have been made within the century. Yours is therefore the seventh premium. It is thus shown that the terms under which the premium can be claimed are difficult to be met, but you have filled them, and I sincerely and cordially congratulate you on your success."



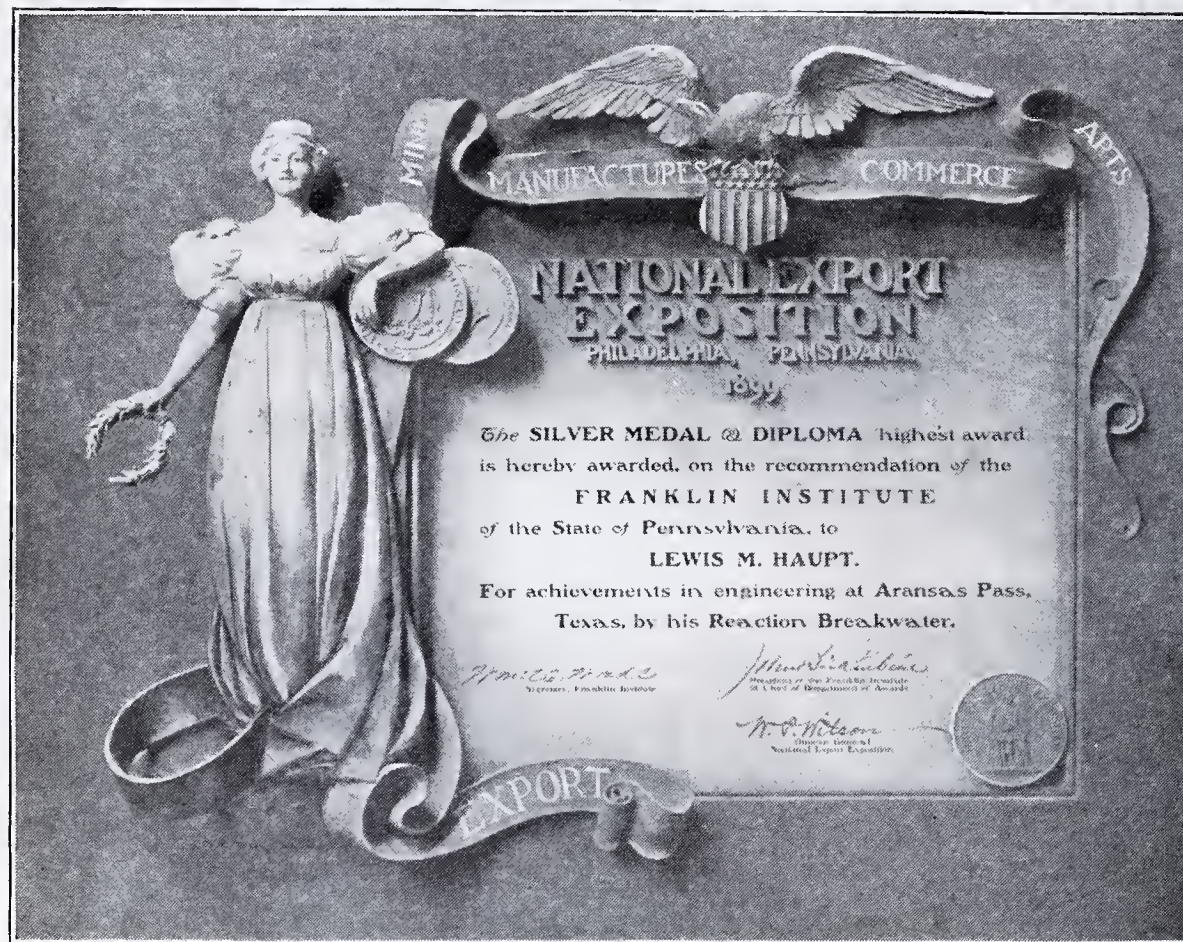
Fred Haley

President



SECOND AWARD, 1899

At the National Export Exposition, at Philadelphia, 1899, a special jury of experts awarded to Professor Haupt its highest premium for Achievements in Engineering at Aransas Pass, Texas, by his Reaction Breakwater. The results secured at this port are shown by the official charts and reports of the U. S. Engineers, of the U. S. Coast and Geodetic Survey, and others.



**Diploma of the National Export Exposition
awarded to Prof. L. M. Haupt for achievements in engineering
at Aransas Pass, Texas.**



THIRD AWARD, 1900

At the instance of Director General Peck an exhibit was sent to the Paris Exposition, not only of the work done at Aransas Pass, but also of its adaptation to the removal of the delta bar at the mouth of the Southwest Pass of the Mississippi River.

A jury of twenty-five distinguished engineers from twelve different countries recommended the award of the gold medal for the models and plans for the removal of ocean bars on alluvial coasts by a single reaction breakwater, and for the opening

of the Southwest Pass by a reaction jetty. The United States was represented in this class by Juror-in-Chief, United States, Dr. J. H. Gore, Prof. of Mathematics, Columbian University, Washington, D. C.

J. A. Ockerson, Civil Engineer, Member of the Mississippi River Commission.

Louis A. Risse, C. E., President of Public Improvements of the City of New York.

G. S. Wilkins, C. E., Expert in charge of the Civil Engineering and Transportation Divisions of the Paris Exposition of 1900.



First Premium
Paris Exposition
1900





Elliott Cresson Gold Medal and Premium

FOURTH HONORARIUM,

1901

The Elliott Cresson Gold Medal of the Franklin Institute was awarded upon recommendation of its "Committee on Science and the Arts," after examination, report, readings and public advertisement, inviting objections.

These conditions having been complied with, the committee reported, *inter alia* :

"In recognition of the scientific research and practical efforts which have culminated in the invention and demonstration of the Reaction Breakwater, and of the economies to commerce resulting therefrom, the Franklin Institute bestows the highest award within its gift, by the Elliott Cresson Medal, upon Professor Lewis M. Haupt, the inventor of this system of harbor improvements."

Countersigned by

R. HEYL, *Chairman*

Committee on Science and the Arts

(Signed) JOHN BIRKINBINE, *President*

WM. H. WAHL, *Secretary*

THE INVENTION

Commerce is the life of nations, but almost every port on an alluvial coast has its obstructing outer bar. In earlier days of light draught ships these were not so serious as at present, yet they have always engaged the attention of maritime engineers, and large sums have been spent in



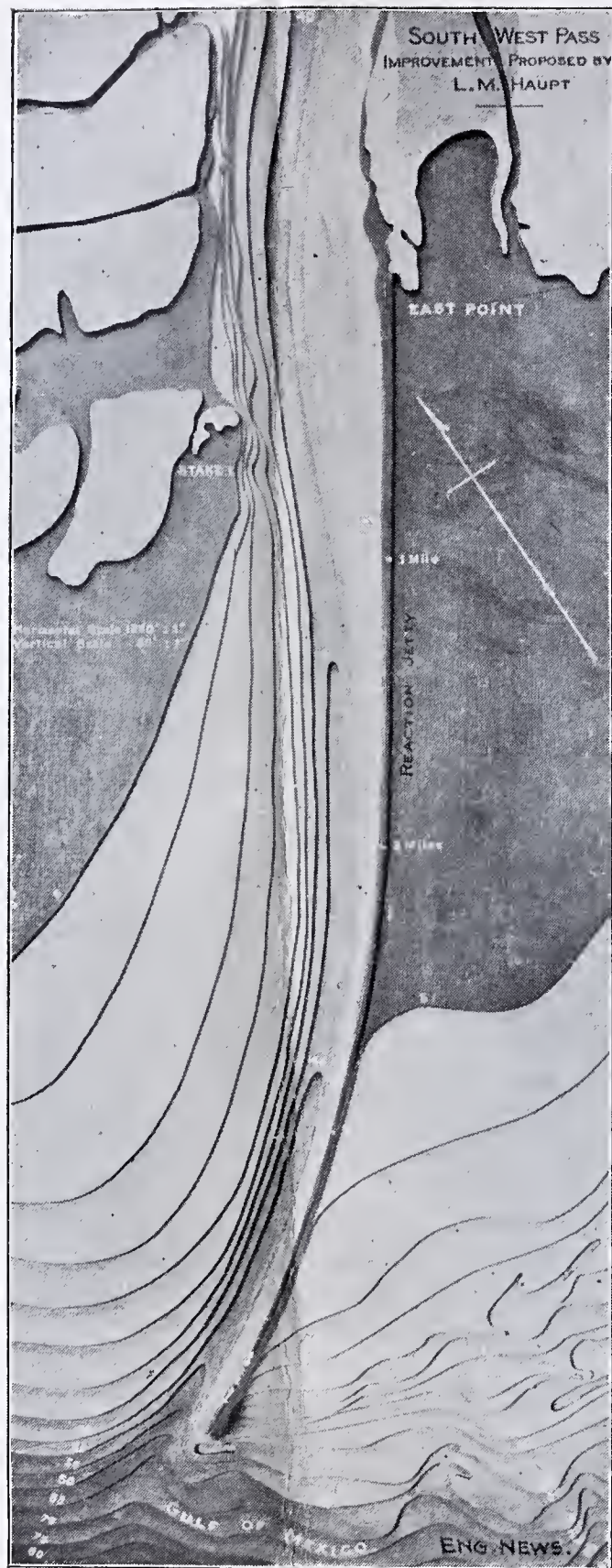
Reaction

efforts to improve them. To reduce the risks of these bars it has been the practice for centuries to build jetties across them, with a view to create a channel by scour or by dredging, but with indifferent results; for, if such twin jetties are too far apart, they cause deposits; or, if too close together, they likewise obstruct the flow and produce shoaling, while their designers generally ignore the natural laws governing the movements of currents in curved lines, by building them straight.

This invention is an evolution from extensive researches and observations of natural causes and effects, which has resulted in the substitution of a single, curved structure, properly located, to defend the proposed channel from littoral drift; to concentrate the ebb movements over a limited path; to admit the full tidal volume into the inner bays; to prevent the seaward movement of the bar by causing a lateral displacement of the material of which it is composed; to fix the location of the channel, which is automatically adjusted to the current movements; to afford an aid to navigation, and above all, to reduce the cost to less than half that of the less effective devices now in use, both for construction and maintenance. Thus, one jetty does double duty, and does it better than two.



Partially Completed Reaction Breakwater at Aransas Pass, Texas, showing results to May, 1900



APPLICATION TO TIDAL ENTRANCES

The operation of the Reaction Breakwater as applied to a tidal entrance is best shown by the results secured by natural forces at Aransas Pass, Texas, where an old jetty formerly built across the channel still remains submerged to restrict the scour, and although no work has been done at this site since 1896, and the breakwater is barely half completed, there has been a progressive deepening from six and a half to fifteen and a half, and, in places, to twenty-five and a quarter feet, without dredging. (See plate on page 9.)

APPLICATION TO SEDIMENTARY RIVER MOUTHS.

The removal of delta bars has hitherto been attempted by two nearly parallel jetties, with the inherent risk of over contraction or over expansion and bar advance. With a single reaction jetty the sediment in suspension is carried transversely to and deposited upon the opposite submerged bank, beyond the reach of the channel, thus constructing automatically a natural levee, adapted to the requirements of the stream, and without cost. The general principle, without detailed elaboration, is shown in the accompanying cut, while the theory and results to be expected are defined more fully in the July number of the Franklin Institute Journal of 1900. (q. v.)

The Reaction Jetty as designed for the opening of the Southwest Pass, Mississippi River.

OFFICIAL POSITIONS, DIPLOMAS AND AWARDS

- 1858, On surveys, Troy and Greenfield R. R. and Hoosac Tunnel, State of Mass.
- 1863, Sept., Cadet, U. S. M. A., West Point, to fill vacancy from 7th Cong. District, Ga.
Appointed by the President, Abraham Lincoln.
- 1867, Commissioned Lieut., U. S. Corps of Engineers, and assigned to duty on the surveys of the Great Lakes, by Pres. Andrew Johnson. (Triangulation and Hydrography.)
- 1869, Feb., U. S. Engineer Officer, 5th Military District, Texas, on staff of Gen'ls E. R. S. Canby and J. J. Reynolds, in charge of Military Roads and of River and Harbor Imp.
- 1869, Sept., Resigned from the U. S. Engineers, under Retrenchment Act, suspending promotions in the Staff Corps.
- 1869, Oct., Assistant Engineer Fairmount Park, Phila., Pa. (Topography and Roads.)
- 1872, June 28, First Asst. Examiner, U. S. Patent Office, class of Engineering and Architecture, Commissioned by Hon. C. Delano, Secretary of Interior.
- 1872, Sept., Instructor in Mathematics and Civil Engineering, University of Penna. Appointed by the Trustees.
- 1874, Asst. Civil Engineer, 4th Lighthouse District, in charge of Hydrographic Surveys for Range Lights on Delaware River, with Gen'l Wm. F. Raynolds, U. S. E.
- 1874, Member Franklin Institute.
- 1874, Oct., Judge, Franklin Institute Exhibition.
- 1874, Dec., Member Historical Society of Pennsylvania.
- 1875, June, Appointed Professor of Civil Engineering, University of Penna.
- 1875, Aid, U. S. Coast and Geodetic Survey, in charge of the Geodesy of Penna.
- 1876, Member American Institute of Mining Engineers.
- 1876, Secretary Bureau of Awards during organization of the Centennial Exposition of 1876.
- 1877, First President, Engineers' Club of Philadelphia.

- 1878, Member American Philosophical Society, 104 South Fifth Street, Philadelphia.
- 1883, Honorary Degree, Master of Science, University of Penna.
- 1885, Member American Association Advancement of Science.
- 1887, The Magellanic Premium awarded for "His discovery in Physical Hydrography, and for his Invention of a system of Harbor Improvements."
- 1888, Member American Society of Civil Engineers, 220 W. 57th Street, New York.
- 1889, Delegate of the Franklin Institute to the International Exposition at Paris.
- 1889, Assistant Judge in Department of Transportation (Railway Plant), Paris.
- 1892, Member, Geographical Society of Philadelphia.
- 1892, Delegate from Pennsylvania to the Nicaragua Canal Convention at New Orleans.
- 1892, Canal Commissioner of Penna. Appointed by Hon. Robt. E. Pattison, Governor.
- 1894, Engineer in charge of Surveys for a Ship Canal across New Jersey. (Edwin S. Stuart, Mayor.)
- 1895, Member Board of Consulting Engineers, Lake Erie and Ohio River Ship Canal, Pittsburgh to Ashtabula. Associates, Gen'l Henry L. Abbot and N. H. Hutton.
- 1896, Delegate to the Cleveland and Topeka Deep Water Conventions.
- 1897, President of Arbitration Commission, U. S. of Colombia *vs.* Cauca Railroad and Colombian Construction Co. Appointed by Hon. John Sherman,—Julio Rengifo.
- 1897, July, Member of the Nicaragua Canal Commission. Appointed by the President, Wm. McKinley.
- 1899, June, Member of the Isthmian Canal Commission. Appointed by the President, Wm. McKinley.
- 1899, Highest Medal and Diploma, National Export Exposition, for the Reaction Breakwater.
- 1900, Member, American Social Science Association.
- 1901, Elliott Cresson Medal and Diploma, Franklin Institute, for Improvements in Methods Removing Ocean Bars.

MONOGRAPHS RELATING TO RIVER AND HARBOR IMPROVEMENTS

- 1869, Protection of Reservation, Fort Brown, on the Rio Grande, Texas.
- 1884, Movable Dams (Chanoine-Pasqueau) as adapted to the Great Kanawha and Ohio. (E. C. *)
- 1886. Jan., Harbor Studies, General Principles. (E. C.)
- 1886, Feb., the New York Entrance, Physical Conditions. (E. C.)
- 1886. Feb., the Delaware Breakwater, Defects and Remedies. (E. C.)
- 1886, Aug., River and Harbor Improvements, Buffalo Meeting, Am. Ass. A. Sci.
- 1887, Oct., the Government and the Public Works. (L. M.)
- 1887, Oct., Improvement of Tidal Rivers as applied to the Delaware River. (F. I.)
- 1887, Dec., Physical Phenomena of Harbor Entrances (awarded, Magellanic Premium). (A.P.S.)
- 1888, Jan., Presentation of Plans to the U. S. Board of Engineers. (Hearing in N. Y.)
- 1888, Feb. 24, Hearing before the River and Harbor Committee. (P. D.)
- 1888, Feb., the Commercial Paradox (the Manufacturers' Club). (M. C.)
- 1888, April, Jetties for Improving Estuaries. (F. I.)
- 1888, May, Reception of Premium and Address. (A. P. S.)
- 1888, June, Great Transportation Areas of the U. S. (E. C.)
- 1888, July, Address to Deep Water Convention (Fort Worth, Texas).
- 1888, Nov., Improvement of Bar at Rio Grande Do Sul, Brazil. (E. C.)
- 1889, March, Dynamic Action of the Ocean in Building Bars. (A. P. S.)
- 1889, April, Fire Island Inlet (movement of). (F. I.)
- 1889, Jetties at Harbor Entrances in the U. S. (Inst. C. E. London).
- 1889. How to Obtain Deep Water on the Gulf. (P. D.)
- 1889, July, Harbor Bar Improvements. (F. I.)
- 1889, Oct., Discussion of Harbor Bar Improvements. (F. I.)
- 1889, Report on Willett's Outer Harbor, Padre Id. Ts. (S. R.)

- 1889, Tidewater Terminals of the Southern States (Railroad Gazette, March and April).
 1890, July, Canals and Economic Transportation. (A. E. A. *)
 1890, Sept., Littoral Movements of the New Jersey Coast, etc. (A. S. C. E.)
 1891, July, Needed Reform in our Public Works. (E. M.)
 1891, Oct., The Galveston Harbor Problem. (F. I.)
 1892, Jan., Address New York Board of Trade and Transportation.
 1892, Jan., the Port of Philadelphia. (F. I.)
 1892, Improvements of Southern Harbors (Mfrs'. Record).
 1892, March, Ship Canal, Philadelphia to New York. (F. I.)
 1892, Sept., Method of Improving the Mississippi River by Weirs. (A. S. C. E.)
 1892, Nov., Ship Canals (general) (F. I.)
 1892, Dec., Address New Orleans Canal Convention.
 1894, The Canals of Commerce (New Science Review).
 1894, March, the Manchester Ship Canal and its Moral. (F. I.)
 1895, Report on the Ship Canal Survey across New Jersey. (S. R.)
 1895, Sectionalism and Railroads *vs.* Canals. (S. R.)
 1895, Discussions, Cleveland International Deep-water Convention. (S. R.)
 1895, Address, Topeka Deep-water Convention, Ks.
 1896, Address, Deep-water Day, Pittsburg, Pa.
 1896, Report of Experts on Lake Erie and Ohio River Ship Canal. (S. R.)
 1896, Feb., Commerce and Deep-waterways. (F. I.)
 1897, Co-editor Nicaragua Canal Commission, Report. (P. D.)
 1898, June, Origin of the Gulf Stream, Discussion. (A. S. C. E.)
 1898, July, National Influence and the Isthmian Canal. (E. M.)
 1899, Address, Friends' Lyceum, Nicaragua Canal.

- 1899, Address, Lutheran Theological Seminary, Nicaragua Canal.
 1899, Address, National Manufacturers' Association, Cincinnati, on Nicaragua Canal.
 1899, Address, Geographical Society of Philadelphia.
 1899, Oct., Historical Resume of Work at Aransas Pass, Texas. (A. P. S.)
 1899, Dec., the Reaction Breakwater for Ocean Bars. (A. S. C. E.)
 1900, March 20, Hearing before River and Harbor Committee Congress. (P. D.)
 1900, July, the Reaction Breakwater for Southwest Pass. (F. I.)
 1901, Hearings before Commerce Committee Senate, on Mississippi River. (P. D.)
 1901, May, Review of Methods of Removing Ocean Bars. (A. P. S.)
 1901, Population and the Isthmian Canal. (L. M.)

*WHERE PUBLISHED

- L. M.—Lippincott's Magazine.
 S. R.—Special Reports.
 M. C.—The Manufacturers' Club of Philadelphia.
 A. P. S.—American Philosophical Society.
 E. C.—Engineers' Club of Philadelphia.
 P. D.—Public Document, Washington, D. C.
 A. E. A.—American Economic Association, Baltimore.
 A. S. C. E.—American Society of Civil Engineers, New York.
 F. I.—Franklin Institute Journal, Philadelphia.
 E. M.—Engineering Magazine, New York.

HARD AGROUND



Remove the bars and let these shuttles glide
To weave the nations, girdled by the tide.

June, 1901

ARRANGED AND PRINTED BY
FRANK H. TAYLOR
718 ARCH ST. PHILA.

**NATURE and SCIENCE attest
the fact that one REACTION
BREAKWATER will accomplish
more than two jetties, in less time
and at FAR LESS COST. ♡ ♡**